UNITED STATES MARINE CORPS
COMMANDER, MARINE FORCES RESERVE
4400 DAUPHINE STREET
NEW ORLEANS, LOUISIANA 70146-5400

ORIGINAL

ForO 5100.14
BOS
30 OCT 1995

FORCE ORDER 5100.14

From: Commander
To: Distribution List

Subj: LASER SAFETY

Ref: (a) MCO 5100.29
(b) SPAWARINST 5100.12B
(c) SECNAVINST 5100.14B
(d) MIL-STD 1425, Safety Design Requirements for Military Laser and Associated Support Equipment
(e) OPNAVINST 5100.23C
(f) NAVMEDCOMINST 6470.2A
(g) OPNAVINST 3710.7N
(h) DoD Document 316-99 (Laser Range Manual)
(i) E0410-BA-GYD-010 (Technical Manual)
(j) MCO 3570.1A
(k) MIL-HDBK-828

Encl: (1) Definitions
(2) Elements of a Laser Safety Program
(3) Laser Range/Mission Briefing Guide
(4) Laser Maintenance Safety Precautions
(5) Sample Medical Screening Request
(6) Sample Laser Incident/Overexposure Premishap Plan

1. Purpose. To provide policy and assign responsibility for the safe use of laser systems within the Marine Forces Reserve (MARFORRES) per references (a) through (k).

2. Cancellation. ForO 5100.4.

3. Background. This Order applies to all MARFORRES activities operating military exempt laser systems, class 3 or class 4 laser systems or class 3 or class 4 lasers embedded in class 1 or class 2 laser systems as defined in enclosure (1). Laser is an acronym for Light Amplification by Stimulated Emission of Radiation. Lasers typically operate in ultraviolet, visible and infrared portions of the electromagnetic spectrum. The biological effects of laser radiation are similar to those of light generated by high intensity light sources such as the sun, nuclear explosions, or arc lamps. However, the chance of eye or skin damage is greater from laser radiation. Laser technology is rapidly proliferating in military applications. Their widespread use increases the probability of personnel exposure and injuries due to laser light. In addition to

biological effects, lasers are also capable of jamming or damaging equipment such as sensors or Night Vision Goggles, thus degrading mission effectiveness. Safeguards are required because injury or damage may occur at considerable distances from the laser source, especially if viewed through magnifying optics.

4. Policy. Per references (a), (d), (e) and (f) the policy of MARFORRES in organizing and managing a local laser safety program is as follows:

a. A Laser Safety Organization shall be established to ensure that adequate laser safety design, training, documentation, and inspections/audits are provided.

b. A Laser System Safety Officer (LSSO) or Laser Systems Safety Manager (LSSM) shall be appointed, in writing, by name and shall establish a Local Laser Safety Program per references (a), (b) and (e). A copy of this appointment shall be forwarded to the LSSO (Cat I) at the appropriate Major Subordinate Command (MSC) (e.g., 4th Marine Division, 4th Marine Aircraft Wing and 4th Force Service Support Group). Enclosure (2) reiterates the requirements for a Laser Safety Program.

c. Laser installations are allowed only for the specified applications. Lasers may only be operated on ranges certified for the specific laser being operated (reference (h) applies). The only exception to this policy is actual combat operations.

d. All personnel required to be in a Laser Range Area or maintenance area, whether or not they are actively involved as laser users, will participate in a Laser Safety Training Program. All personnel involved in laser operations shall be thoroughly briefed as per enclosure (3) of this Order prior to each operation. Maintenance personnel working with lasers shall also comply with enclosure (4) of this Order.

e. No Class 3, Class 4, or military exempt laser systems may be used within MARFORRES unless approved by the Space and Naval Warfare Systems (SPAWAR) command's Laser Safety Review Board (LSRB).

f. No laser systems under development may be procured, tested, or evaluated using MARFORRES personnel or facilities until reviewed by the MARFORRES (LSSO) and approved by the Commander, MARFORRES. Requests for evaluations of new systems by MARFORRES activities or commands shall be made in writing with an appropriate hazard analysis of the system attached to the request. Requests shall be sent to MARFORRES (BOS).

g. All personnel who are required to be down range from an operating laser, and all aircrew who operate in the vicinity of lasers on a restricted range or actually conducting laser operations, shall be considered "laser users". This classification will be used for the purpose of medical monitoring as defined in reference (f). All such personnel shall be equipped with appropriate laser eye protection as required by reference (g) or as required by local range operating instructions.

h. Commands in possession of, or operating military exempt laser systems, Class 3b or Class 4 laser systems, or embedded laser systems containing a Class 3b or Class 4 laser shall have at a minimum, an LSSO certified at the Category II level (LSSM). The MARFORRES, 4th Marine Division and 4th Marine Aircraft Wing LSSO's shall be a Category I certified LSSO.

i. The MARFORRES, 4th Marine Division and 4th Marine Aircraft Wing LSSO's shall coordinate with (SPAWAR) (Code (OOF)) to conduct Category II certification courses. The scheduling of the courses shall be announced via naval message. Funding shall be provided in accordance with the current policies of the MSC's.

j. Enclosures (5) and (6) are provided as samples of a medical screening request and laser incident/overexposure premishap plan.

5. Records Disposition. All records must be maintained for a period of 5 years as outlined in enclosure (2). Disposal thereafter shall be in accordance with SECNAVINST 5212.5.

6. Action. Unit Commanders shall implement this Order and comply with the references in establishing a Laser Safety Program.

7. Reserve Applicability. This Order is applicable to the Marine Corps Reserve.

J. M. MALONEY
Chief of Staff

DISTRIBUTION: D

Copy to: COMNAVAIRRESFOR

DEFINITIONS

1. Laser Classifications. The four laser hazard classifications determine the extent of radiation safety control required. These range from Class 1 lasers, which are inherently safe for direct beam viewing under all conditions, to Class 4 lasers which require stricter controls.

2. Embedded Laser. When a laser is disassembled for maintenance and protective features or safety devices are removed, the laser classification may change to a more hazardous class. For example, a laser system classified as a Class 1 or Class 2 eye-safe laser may actually have a Class 3b or Class 4 laser embedded in the system. If the protective housings or filters are removed for maintenance purposes, the laser system must then be treated as a hazardous Class 3b or Class 4 laser by the maintenance personnel. The operators of the intact system would only be required to treat the system as an eye-safe Class 1 or Class 2 laser. The removal of, or tampering with, protective covers, filters or housings is strictly prohibited.

3. Military Exempt Lasers. These are lasers designed for actual combat, combat training operations, or classified in the interest of National Security. Because some safety devices required by reference (b) would defeat the functioning of these lasers, the design of these systems are granted exemptions by reference (c) if they meet the requirements of reference (d). All military exempt lasers, regardless of classification, can only be transferred or disposed of with the written permission of the Space and Naval Warfare Systems (SPAWAR) command (Code OOF).

ELEMENTS OF A LASER SAFETY PROGRAM

The nine elements of a local Laser Safety Program are as follows:

1. THE LOCAL LASER SAFETY ORGANIZATION

a. The site shall designate a Laser System Safety Officer (LSSO) in writing, by name and code, to work directly with the CO and have sufficient technical competence and authority to approve or disapprove the local use of lasers. The LSSO shall be responsible for implementing the Laser Hazards Control Program required by SPAWARINST 5100.12B.

b. Laser or laser system supervisors shall be designated and given written safety responsibilities which shall include normal installation planning, operational procedures, accident investigations and a log of all laser firings.

c. Where appropriate, a local Laser Safety Committee may be established, chaired by the LSSO, to assist the LSSO in meeting the requirements for the Laser Hazard Control Program.

d. To implement a local Laser Safety Program, the LSSO must be designated and do the following:

(1) Establish a budget and command support.

(2) Establish local Laser Safety Program policy, regulations and/or standard operating procedures.

(3) Identify employee risk categories and establish a Medical Surveillance Program.

(4) Establish hazard analysis and safety review/approval capability.

(5) Implement supervisor/personnel training programs.

(6) Provide protective equipment for laser and secondary hazards with a periodic inspection.

(7) Establish mishap investigation/reporting procedures.

(8) Conduct periodic facility audits/inspections.

(9) Conduct periodic rebriefing of laser personnel.

ENCLOSURE (2)

(10) Conduct periodic review of Laser Safety Program requirements.

(11) Establish a set of records and files.

(12) Report Class 3b, Class 4 and Military Exempt Lasers in accordance with reference (a), annually.

2. LOCAL LASER SAFETY REGULATIONS

a. The site must have laser safety regulations which establish laser safety policy and standard operating procedures for safety of indoor and outdoor laser operations. It is the responsibility of the LSSO to establish and distribute local laser safety regulations.

b. Local laser safety regulations or standard operating procedures may be submitted to the MSC or MARFORRES (BOS) for review/critique.

3. ACTIVITY SURVEY/INSPECTION OF LASERS

a. A laser survey must be done to establish a laser equipment inventory, identify personnel who require medical surveillance and to survey/inspect laser installations for safety.

b. A laser equipment inventory and hazard classification of lasers is required for hazard control. Records must be kept and particular attention should be paid to the Class 3b, Class 4 and Military Exempt Lasers, since their use and disposition must be reported annually in accordance with reference (a). The inventory records should identify the laser, its operating characteristics, hazard classification, application, frequency of operation, its physical location and the individual(s) responsible for its disposition.

c. During the laser survey, all personnel who may be exposed to laser radiation must be identified as to their risk category (incidental or laser personnel). Records must be kept as to the equipment used, their job assignment, education, training, time on the job and laser related medical history. The LSSM will consider several factors when assigning a risk category as defined in references (a) and (b). As an example, personnel who operate Ground Employed Military Lasers on approved ranges and those personnel who remain behind the laser firing position to observe the operation are classified as incidental personnel. Additionally, a Selected Marine Corps Reserve (SMCR) Marine, who

comes in contact with laser radiation by the nature of his civilian occupation will be classified as a "Laser User". The latter are to be submitted to the medical officer for medical surveillance per BUMEDINST 6470.2A. Enclosure (5) of this Order provides a sample Medical Screening Request.

d. Each activity's laser installation(s) must be thoroughly inspected periodically (at least once per year) to ensure that they continue to meet safety requirements. The inspection must include, but not be limited to, a review of the standard operating procedures, operator training, equipment condition and the condition and use of protective eye wear or other protective equipment. In addition, the installation(s) must be inspected to assure that the required warning systems and signs are in appropriate locations to warn unsuspecting personnel of the presence of potentially harmful laser radiation.

e. The following list of secondary or nonbeaming hazards should be kept in mind during inspections:

(1) Electrical hazards.

(2) Use of cryogenics.

(3) Compressed gases.

(4) Toxic material.

(5) Noise.

(6) Arc of filament lamps.

(7) Targets which may shatter.

(8) Ionizing radiation.

(9) Incoherent visible and ultraviolet radiation from laser discharge tubes or flash lamps.

(10) Hazardous by-products may result from the reaction of the laser radiation, especially ultraviolet laser radiation, with air and other substances; for example, formation of ozone, skin irritation agents, etc.

f. The local ground safety manager or officer shall assist the LSSO/LSSM in conducting the annual survey/inspection of the laser installation and review of the Laser Safety Program.

4. LASER SAFETY TRAINING PROGRAM

a. The amount of training that activity personnel require is based upon the class of laser to which the individual is routinely exposed while unsupervised and the risk category assigned to that person.

(1) Exposure to a Class 1 or 2 laser requires no special training.

(2) Exposure to a Class 3a laser requires that the affected personnel be given a review of laser characteristics and be forbidden to directly view the laser beam or its specular reflection, especially with magnifying optics.

b. All personnel assigned a risk category of "Incidental" shall receive a safety brief prior to the participation in, or observation of, the laser operation. This safety brief shall encompass the subject matter listed in paragraph 4c below but may be done in a much abbreviated manner. Additional information covering local range specifics shall also be included. Enclosure (3) pertains.

c. All personnel assigned a "Laser User" category while working in areas using Class 3b, Class 4 or equivalent Military Exempt Lasers shall have a minimum of 4 hours of formal classroom training which covers the following:

(1) Laser Fundamentals.

(2) Biological Effects.

(3) Specular and Diffuse Reflections.

(4) Other Hazards (e.g., electrical, chemical, etc.).

(5) Laser System Classification.

(6) Control Measures.

(7) Responsibilities.

(8) Medical Surveillance Requirements.

5. LASER PROTECTIVE GOGGLES/EQUIPMENT PROGRAM

a. This program is to ensure that all exposed personnel, both in work areas or down range, are adequately protected from laser radiation. Goggles must be properly labeled and periodically inspected. Such inspection shall be conducted and documented at least annually or after an extended storage period of more than 6 months. With usage and environmental factors varying greatly, a more frequent schedule of such inspections may be left to the discretion of the LSSM. Any protective eye wear with scratches, cracks or other signs of excessive wear must be replaced. There should be enough goggles with the proper optical density at the appropriate wavelengths to handle any number of visitors required to be in the laser hazard area.

b. In the case, that proper laser eye wear is not available through the normal supply system, it must be open purchased. Planning and budgeting is essential for having the eye wear available for personnel at risk. The LSSO/LSSM should maintain a file with sources for ordering the eye wear appropriate for his/her installation.

c. Requests for funding shall be in accordance with the current policies of the MSC's. Laser eye wear, which is available in the supply system, shall be ordered through that system.

6. MEDICAL SURVEILLANCE PROGRAM

a. A Medical Surveillance Program must be established per BUMEDINST 6470.2A. All personnel routinely exposed to laser radiation above the Maximum Permissible Exposure (MPE) must be identified and their record submitted to the medical officer for medical surveillance.

b. The command's LSSO/LSSM shall maintain a list of laser user personnel and laser incidental personnel, to include documentation of completion of the medical surveillance examinations/tests. The examination shall also be documented in the individual's health record. For individuals whose examinations are normal, a simple statement such as "Laser Medical Surveillance Exam conducted IAW NAVMEDCOMINST 6470.2" entered and dated on the "Chronological Record of Medical Care" (Standard Form 600), will suffice. If abnormalities are found during the examination, they should be documented and the individual referred to an optometrist or ophthalmologist for evaluation and photographic documentation.

7. MISHAP INVESTIGATION/REPORTING PROCEDURES

a. Procedures must be established to investigate any laser related mishap. Should a mishap occur, a report must be made, filed, and appropriate corrective actions initiated. Incidents involving overexposure to lasers, with or without eye injury, shall be reported by telephone Flash Report to MARFORRES (BOS) DSN: 678-6809/6800 or Coml: (504) 678-6809/6800 within 24 hours of the incident using the same format as a Ground Mishap Report. After normal working hours, contact MARFORRES Staff Duty, DSN: 678-1290/1210 or Coml: (504) 678-1290/1210.

b. If a laser induced eye injury is suspected or observed, a complete medical eye examination must be conducted by an ophthalmologist or optometrist as soon after the exposure as practicable. Prompt examination is important since medical intervention may help to mediate certain injury conditions, and the distinctiveness of very mild or minor retinal lesions may begin to fade shortly after exposure. Color retinal photographs are preferred as a record for documentation.

c. BUMEDINST 6470.2A requires a message report for a laser overexposure or suspected laser eye injury to be sent to BUMED WASHINGTON DC//MED 02// as soon as possible. Include COMMARFORRES//BOS//;CMC//SD//; SPAWAR//OOF// and others in your chain of command as additional information addressees. In the event an aircraft is involved, also inform NAVSAFECEN//10//11//. A formal report, with the information requested in BUMEDINST 6470.2A shall be forwarded via the chain of command within 30 days. Step 7 of enclosure (6) of this Order applies.

d. An investigative board consisting of the local LSSO/LSSM, the MSC's LSSO (Cat I) or designated representative, Ground Safety Manager/Officer and a medical officer shall be convened to:

(1) Determine the estimated exposure.

(2) Determine the cause of the overexposure.

(3) Provide the required information per BUMEDINST 6470.2A.

(4) Make recommendations to prevent a similar occurrence.

e. A short premishap plan which lists the required reports, time frames, members of the investigative board and notification procedures to be used shall be prepared prior to any laser mission.

Enclosure (6) of this Order is a sample of a premishap plan for a laser overexposure.

f. If a laser overexposure incident is caused by lasers not belonging to U.S. forces, refer to MCO 3430.3C, "Reporting Meaconing, Intrusion, Jamming and Interference of Electromagnetic Systems, RCS: JCS 1066 (MIN)," for JCS notification requirements.

8. RECORDS. The LSSO must keep an extensive set of records on laser systems, laser applications and the requirements for documentation related to personnel working with lasers. Proof of medical surveillance examinations, annual inspections, training rosters and outlines, laser eye protection ordering information, laser safety regulations, and annual inventory reports are required. Laser firing logs are required for both indoor and outdoor use of lasers. These records shall be maintained for a period of 5 years.

9. REPORTING

a. The LSSO must maintain an inventory of all lasers and their location at his activity. This inventory is utilized in the submission of annual inventory reports on all Class 3b and Class 4 lasers as well as all Military Exempt Lasers in accordance with reference (a), with a copy submitted to SPAWAR (OOF) as required by SECNAVINST 5100.14B.

b. The annual inventory reports shall be submitted in accordance with reference (a) with a copy submitted via the chain of command and are due not later than 15 August of each year at MARFORRES (BOS). The formats for the inventory reports can be found in SPAWARINST 5100.12B.

LASER RANGE/MISSION BRIEFING GUIDE

1. Each laser range/mission shall be briefed with reference to each of the following three topics as a minimum:

a. Laser range

(1) Boundaries.

(2) Permissible lasing area.

(3) Buffer zones, back stop terrain.

(4) Roads, wildlife, pipelines, wires and towers.

(5) Laser "on/off" procedures and communications.

b. Target identification procedures

(1) Clearing pass (aircraft) - heading, altitude.

(2) Means of target identification.

(3) Manned or unmanned.

(4) Radio - frequencies and call signs, if applicable.

(5) Target/Range times.

(6) Controlling authority, call signs/frequency.

c. Laser Tactics

(1) Expected items, heading and altitude of laser firings. (aircraft)

(2) Protective eye wear, preflight and use of (aircraft).

(3) Other aircraft, altitudes and headings during lasings; ordnance to be delivered; and protective eye wear availability.

(4) Expected laser "footprint" dimensions.

(5) Aircraft flight profile (as appropriate).

ENCLOSURE (3)

2. The briefing will be conducted by the Range/Mission Commander and all personnel who wish to be present during laser operations, regardless of rank, shall attend. Absence from this briefing shall dictate exclusion from the range during operations.

LASER MAINTENANCE SAFETY PRECAUTIONS

1. Laser hazard warning signs shall be posted on all entrances to laser maintenance areas per SPAWARINST 5100.12B so as to minimize the risk of accidental exposure. The laser units and test benches shall be posted as well.

2. All personnel engaged in essential duties concerned with laser firing shall wear approved protective eye wear during firing. Nonessential personnel shall leave the laser area during firing.

3. All functional entrances to bench and bore sight laser firing areas shall be interlocked so that opening such a door will stop laser emission.

4. Equipment interlocks shall be maintained in operating condition at all times. In the event that required and approved maintenance procedures can only be performed by circumventing some interlock feature, that procedure will be performed only under the direct supervision of a designated laser safety supervisor subject to the prior approval of the Maintenance Officer. In all such cases, a documented quality assurance inspection shall be performed at the completion of that work to ensure that proper interlock operation is restored.

5. Appropriate and adequate laser radiation containment procedures and devices shall be in effect whenever any laser is fired. Examples of containment devices are lens covers, diffusers, baffles, shields and enclosures.

6. The laser test area shall be kept clear of all specular reflectors and those reflectors with a high coefficient of specular reflection.

ForO 5100.14
30 OCT 1995

SAMPLE MEDICAL SCREENING REQUEST

From: Laser System Safety Manager, (Unit name)
To: Commanding Officer, Branch Clinic, Naval Hospital, etc.

Subj: LASER SAFETY EYE/PHYSICAL EXAMINATION REQUEST

Ref: (a) BUMEDINST 6470.2A

1. Per the reference, it is requested that the following individual be given a preplacement laser eye/physical examination:

Name:_____Rank:_____SSN/MOS:_____

2. Risk category: Incidental or Laser User (Circle one)

3. Upon completion of the exam, please return this form with the following information completed.

The above named individual received an eye examination and was questioned concerning the use of photosensitizing drugs and is/is not medically qualified to work with lasers in the risk category indicated.

Examination completed by:_____
NAME/TITLE

Date completed:_____

Signature:_____

ENCLOSURE (5)

ForO 5100.14
30 OCT 1995

SAMPLE LASER INCIDENT/OVEREXPOSURE PREMISHAP PLAN

SEQUENCE	ACTION/DUE DATE	PHONE NUMBERS
STEP 1	SEND EXPOSED INDIVIDUAL(S) TO LOCAL MEDICAL CLINIC EMERGENCY ROOM WHEN: IMMEDIATELY WHERE:_____(location)_____ (NOTE: INDIVIDUALS MUST BE EXAMINED BY AN OPHTHALMOLOGIST OR OPTOMETRIST AS SOON AS POSSIBLE)	
STEP 2	SECURE THE LASER SITE, IF FEASIBLE WHY: TO PRESERVE EVIDENCE AND PREVENT A REOCCURRENCE	
STEP 3	NOTIFY THE FOLLOWING PERSONNEL: COMMANDING OFFICER COMMAND LSSO/LSSM GROUND SAFETY MANAGER/OFFICER MSC LSSO	_____ _____ _____ _____
STEP 4	FLASH REPORT DUE VIA PHONE TO MARFORRES (BOS) WHEN: WITHIN 24 HOURS OF INCIDENT	DSN: 678-6809 COML: (504) 678-6809/6800
STEP 5	NOTIFICATION MESSAGE TO BUMED MSG PLAD: BUMED WASHINGTON DC//MED 02// REPORT CONTROL SYMBOL: MED 6470-13 INFO TO: COMMARFORRES//BOS// CMC WASHINGTON DC//SD// SPAWAR//OOF// OTHERS AS REQUIRED CONTENT: WHAT HAPPENED, POC, INVESTIGATION IN PROGRESS & PRELIMINARY MEDICAL RESULTS WHEN: AS SOON AS POSSIBLE (NLT 72 HOURS)	

ENCLOSURE (6)

SAMPLE LASER INCIDENT/OVEREXPOSURE PREMISHAP PLAN - CONTINUED

SEQUENCE	ACTION/DUE DATE	PHONE NUMBERS

STEP 6 CONVENE MISHAP INVESTIGATION BOARD

WHEN: WITHIN 48 HOURS IF POSSIBLE

BOARD MEMBERS:

LSSM: _____
MSC LSSO: _____
GSM/O: _____
MED O: _____

STEP 7 FORMAL WRITTEN REPORT TO BUMED VIA CHAIN OF COMMAND

FROM: (SITE)
TO: BUMED WASHINGTON DC//MED 02//

VIA: (1) OTHERS IN THE CHAIN OF COMMAND AS REQUIRED
(2) COMMARFORRES//BOS//
(3) CMC WASHINGTON DC//SD//

COPIES TO: COMSPAWARSYSCOM WASHINGTON DC//OOF//

INFORMATION REQUIRED:

A. PERSONNEL INVOLVED
B. PHOTOS OF LASER & ITS SETTINGS
C. DESCRIPTION OF LASER SYSTEM
D. WAVELENGTH
E. MODE OF OPERATION/PULSE DURATION
F. ENERGY/POWER OUTPUT
G. EXPOSURE ESTIMATE VERSUS MPE
H. MEDICAL EXAM RESULTS & RETINAL PHOTOS
I. NARRATIVE SUMMARY OF INCIDENT
J. DETAILS CONCERNING SAFETY PROCEDURES/EQUIPMENT
K. SITUATIONAL/FOLLOW-UP EXAM RESULTS
L. WHAT HAS BEEN DONE TO PREVENT ANOTHER INCIDENT

WHEN: WITHIN 30 DAYS OF THE INCIDENT

ENCLOSURE (6)